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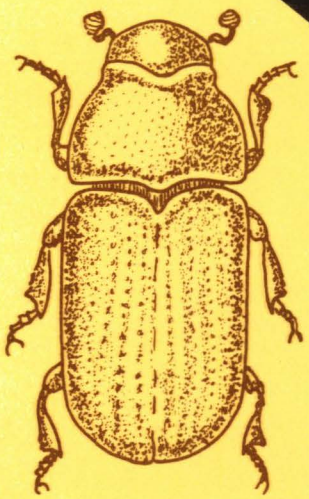
BIOLOGICAL EVALUATION
Southwestern Dwarf Mistletoe on the Elk Springs Burn

Mescalero Apache Indian Reservation, New Mexico

January 1980



Southwestern Region

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Forest Insect and Disease Management
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INTRODUCTION

The Elk Springs Fire, located on the Mescalero Apache Indian Reservation, New Mexico, started on May 4, 1971, and burned approximately 20,000 acres stocked by ponderosa pine, Douglas-fir, southwestern white pine, white fir, pinyon pine, juniper, and oaks. Scattered individuals and groups of trees within the burn survived the fire and were left when the area was salvaged-logged. Ponderosa pine is now being planted in the burn; future plantings will include ponderosa pine and Douglas-fir.

Southwestern dwarf mistletoe (Arceuthobium vaginatum subsp. cryptopodum) is parasitizing residual ponderosa pines in the burned area. This evaluation was made in order to determine the number of infected trees in part of the burn planted within the last 2 years, and to provide management alternatives designed to protect the resulting plantations from the parasite.

CAUSAL AGENT

Southwestern dwarf mistletoe (SWDM) infects ponderosa pine and (very rarely) southwestern white pine; other tree species present in the Elk Springs Burn are immune. SWDM is a green plant with leaves so reduced in size that they are essentially nonfunctional; it therefore depends on the host tree for nutrients and water. Infected parts of host trees appropriate more than their share of nutrients, causing swollen branches at or near the site of infection. Witches' brooms, dense masses of distorted branches, are also formed as a result of infection and further serve to drain nutrients from healthy parts of trees.

SWDM causes several types of losses: growth, seed production, and wood quality decrease as infection level increases. Heavily infected trees can be killed outright; in addition, they become predisposed to attack by insects, which may then attack other nearby trees, resulting in group kills.

Several features of SWDM are important in assessing losses in the Elk Springs Burn and determining applicable control measures, including: 1) Douglas-fir is immune to this parasite; therefore, it can be safely grown under infected ponderosa pines; 2) SWDM spreads by means of seeds which are forcibly ejected, but which travel only a short distance. A rough rule of thumb is that seeds can travel outward from an infected tree for a distance equal to the height of the infection in the tree up to about 100 feet; and 3) it is an obligate parasite, which cannot survive if the host, or infected portions, are killed.

METHODS

Areas within the burn which were replanted in 1978 and 1979 were delineated on maps and aerial photos. The plantations were then divided into smaller units, with boundaries on easily identified landmarks, such as roads, ridgetops, and watercourses. All ponderosa pines in each unit, and those located outside the units but less than 100 feet from the boundary, were inspected; infected trees were counted and their locations marked on aerial photos. Infected trees within some of the units were marked with a band of red tree-marking paint. All units were not marked because of a shortage of paint guns. One unit was not inspected because of lack of time.

RESULTS

Approximately 1,350 acres were surveyed (Figs. 1 & 2). One thousand six hundred and fifty-two infected pines were found, an average of 1.22 trees per acre. The residual trees consist of isolated individuals, small groups, and some small stands. SWDM was not uniformly distributed throughout the residuals; some trees or groups of trees were heavily infected, while others were completely free of the parasite. The boundary of the fire was heavily infected in two areas (Fig. 1).

ALTERNATIVES

Four alternatives can be identified; selection of the first will not protect the plantations from the effects of SWDM and will probably mean that timber management goals will not be reached in the Elk Springs Burn. Selection of any or all of the others will protect the plantations and result in the eventual erradication of SWDM from the Burn. The alternatives and their results are:

1. Replant the burn without controlling SWDM. No additional expenses would be incurred beyond the planting costs. If this alternative is followed, planted seedlings in large parts of the surveyed area, and possibly the rest of the burn, will be exposed to mistletoe seeds and will become infected. Infection at an early age, with additional infections occurring as the planted seedlings grow older, will result in a high mortality rate and decreased growth of surviving reproduction. Infections will gradually spread to other nearby seedlings beyond the SWDM seed dispersal zone of the overstory. This spread will be much slower than spread from the overstory to the understory, probably at the rate of 2-3 feet through the stand per year.

2. Plant resistant species within the seed dispersal zone of infected overstory trees. Since ponderosa pine is essentially the only host of SWDM, other tree species such as Douglas-fir can be planted underneath or near infected pines. This alternative would prevent infection of planted pines; any pine regeneration established within

the SWDM seed dispersal area of infected trees would become infected and eventually die. Some spread from infected natural regeneration to planted pines might take place. The result would be stands containing only Douglas-fir and infected pine overstory. Supposing that alternative species are available, exercising this option would incur no additional costs beyond the identification and marking of areas to be planted to each species.

3. Killing of infected residual trees. Girdling, poisoning, or felling infected trees will kill SWDM. Stems may be removed if practical, but this is not necessary.

Felling should be accomplished before planting, but in no case should it be delayed more than 3 years because the infection rate in planted trees will increase rapidly over time. All infected overstory trees must be treated, including those on the margin of the plantations within seed dispersal range of susceptible seedlings. Hadfield and Russell (1) discuss residual removal in the Pacific Northwest, and the points they make are appropriate to the Southwest.

Following this recommendation will effectively remove mistletoe from the treated areas for several rotations, at least. A similar project now being completed in Arizona by means of a contract, was estimated to cost $3.00 per tree poisoned with monosodium acid methanearsonate (MSMA). It now appears that the actual cost will be less than the estimated cost.

4. Combinations of alternatives 2 and 3. Infected pines would be killed and pines replanted, except in sensitive areas, for instance, along roads where infected pines would be left and the area planted to nonsusceptible species.

RECOMMENDATIONS

Because of the high costs of plantation establishment, and because erradication of mistletoe is fairly simple under the conditions present on the Elk Springs Burn, management of this pest is recommended, using either alternative 2 or the combination, alternative 4.

LITERATURE CITED

1. Hadfield, J. S. and K. W. Russell. 1978. Dwarf mistletoe management in the Pacific Northwest. Pp. 73-81. In Scharf, R. F. and J. R. Parmeter, Jr. (Eds.) Proc. symposium on dwarf mistletoe control through forest management. USDA Forest Serv. Gen. Tech. Rep. PSW-31. 190 pp.

APPENDIX

Figure 1.--Part of the Elk Springs Burn. Areas surveyed are delineated in black. Infected boundaries are indicated in red.

Figure 2.--Part of the Elk Springs Burn. Areas surveyed are delineated in black.